Session 12 Additional Exercise

Problem Statement 1:

A company manufactures LED bulbs with a faulty rate of 30%. If I randomly select 6 chosen LEDs, what

is the probability of having 2 faulty LEDs in my sample? Calculate the average value of this process. Also evaluate the standard deviation associated with it.

Solution:

p = Success = 0.7;

q = Failure = 0.3

1. Calculate Mean

μ = E(x) = n. p

Where:

n = No. of Trials = 6

p = Success ratio = 0.7

 ∴ Mean   = 6*0.7

            = 4.2

2. Standard Deviation

$$\sigma = \sqrt{npq}$$

Where:

n = No. of selected Leds = 6

p = Success ratio = 0.7

q = Failure ratio= 0.3

 ∴ Standard Deviation = √6*0.7*0.3

                = 1.12

Problem Statement 2:

Gaurav and Barakha are both preparing for entrance exams. Gaurav attempts to solve 8 questions per day with a correction rate of 75%, while Barakha averages around 12 questions per day with a correction rate of 45%. What is the probability that each of them will solve 5 questions correctly? What happens in cases of 4 and 6 correct solutions? What do you infer from it? What are the two main governing factors affecting their ability to solve questions correctly? Give a pictorial representation of the same to validate your answer.

Solution:

<u>Gaurav:</u>
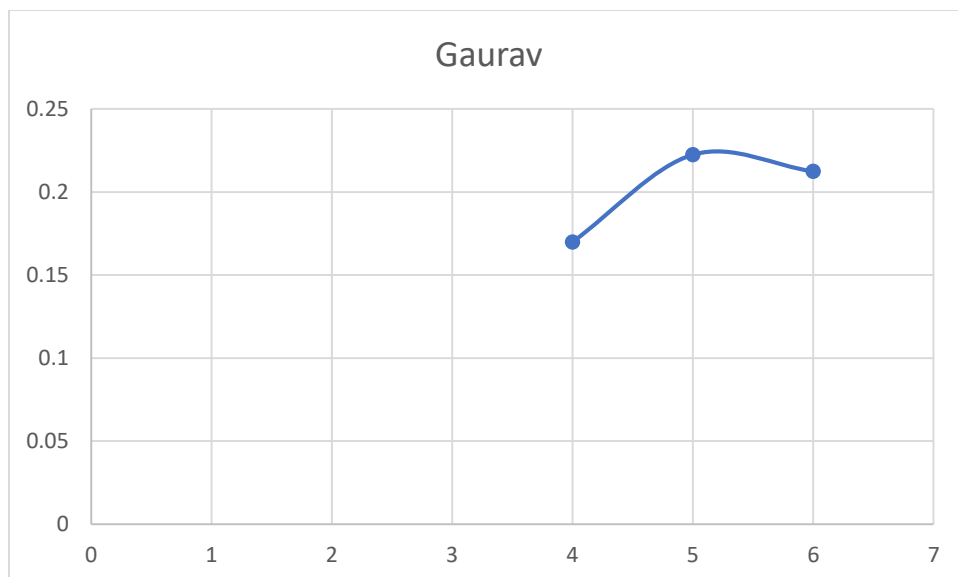
n = 8

p = 0.75

q = 0.25

$p(x =5) = 8c_5 * (0.75)^5 * (0.25)^3 = 0.155728125$

$p(x =4) = 8c_4 * (0.75)^4 * (0.25)^4 = 0.086515625$

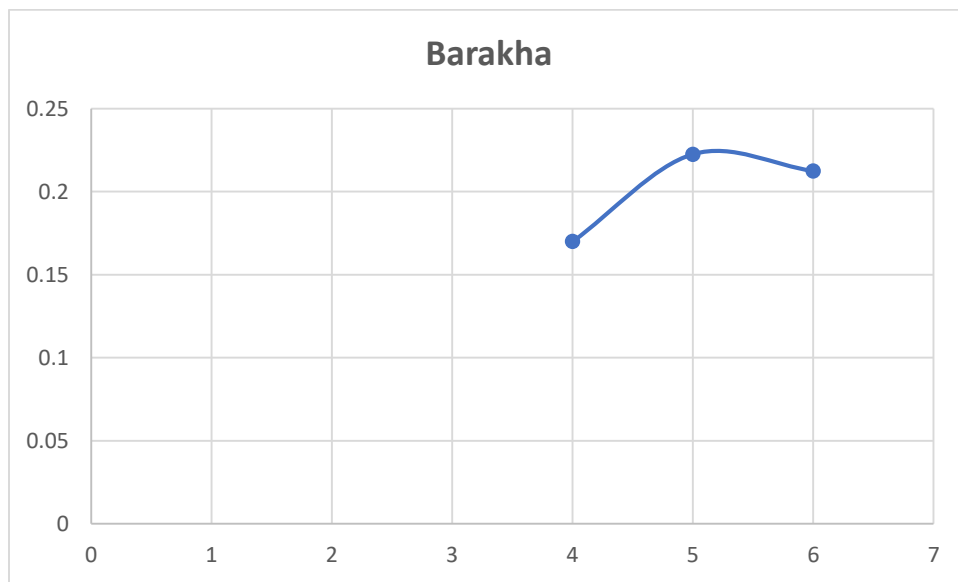$p(x =6) = 8c_6 * (0.75)^6 * (0.25)^2 = 0.31146$

<u>Barakha:</u>

n = 12

p = 0.45

q = 0.55

$$p(x=5) = 12c_5 * (0.45)^5 * (0.55)^7 = 0.22249$$

$$p(x=4) = 12c_4 * (0.45)^4 * (0.55)^8 = 0.169962$$

$$p(x=6) = 12c_6 * (0.45)^6 * (0.55)^6 = 0.212378$$

Barakha

Problem Statement 3:

Customers arrive at a rate of 72 per hour to my shop. What is the probability of k customers arriving in 4 minutes?

a) 5 customers, b) not more than 3 customers, c) more than 3 customers.

Give a pictorial representation of the same to validate your answer.

Solution:

60 minutes   - 72 customers are arriving

4 minutes - ?

$$\frac{4}{60} * 72 = 4.8$$

*2548.09

a) 5 Customer

$$\frac{e^{(-4.8)} * (4.8)^5}{5!} = \frac{0.008229 * 2548.09}{120} = 0.1747$$

b) Not more than 3

X=0

$$\frac{e^{(-4.8)} * (4.8)^0}{0} = 0.008229$$

X=1

$$\frac{e^{(-4.8)} * (4.8)^1}{1!} = 0.008229 * 4.8 = 0.0394992$$

X = 2

$$\frac{e^{(-4.8)} * (4.8)^2}{2!} = \frac{0.008229 * 23.04}{2} = 0.09479$$

X = 3

$$\frac{e^{(-4.8)} * (4.8)^3}{3!} = \frac{0.008229 * 110.592}{6} = 0.151676$$

$$P(xi<=3) = 0.008229 + 0.0394992 + 0.09479 + 0.151676$$

$$= 0.2941942$$

c) More than 3 customers

X = 4

$$\frac{e^{(-4.8)} * (4.8)^4}{4!} = \frac{0.008229 * 530.8}{24} = 0.1820$$

X=5

$$\frac{e^{(-4.8)} * (4.8)^5}{5!} = \frac{0.008229 * 2548.09}{120} = 0.1747$$

X = 6

$$\frac{e^{(-4.8)} * (4.8)^6}{6!} = \frac{0.008229 * 12230.59}{720} = \textbf{0.1397}$$

P(xi>3) = 0.1820+0.1747+ 0.1397= 0.4964

Cusomers visiting

Problem Statement 4:

I work as a data analyst in Aeon Learning Pvt. Ltd. After analyzing data, I make reports, where I have the efficiency of entering 77 words per minute with 6 errors per hour. What is the probability that I will commit 2 errors in a 455-word financial report?

What happens when the no. of words increases/decreases (in case of 1000 words, 255 words)? How is the λ affected? How does it influence the PMF? Give a pictorial representation of the same to validate your answer.

Solution:

6 errors per hour

Per hour words   77*60 =4620

1 error $= \dfrac{6}{4620} = \dfrac{1}{770}$

$M = \dfrac{455}{770} = \textbf{0.591}$

$(\textbf{pxi=2}) = \dfrac{e^{(-0.591)} * (0.591)^2}{2!} = \dfrac{0.55377 * 0.349281}{2} = \textbf{0.09671}$

$M = \dfrac{1000}{770} = \textbf{1.2987}$

$(\textbf{pxi=2}) = \dfrac{e^{(-1.2987)} * (1.2987)^2}{2!} = \dfrac{0.2731 * 1.6866}{2} = \textbf{0.2303}$

$M = \dfrac{255}{770} = \textbf{0.3311}$

$(\textbf{pxi=2}) = \dfrac{e^{(-0.3311)} * (0.3311)^2}{2!} = \dfrac{0.7181 * 0.1962}{2} = \textbf{0.0393621}$

words chart